Preliminary Needs Assessment

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Roadway
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Program

Roadway Safety Professional Capacity Building Program Preliminary Needs Assessment

Report

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Prepared for:

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TABLE OF CONTENTS

I. Executive Summary	1
Findings	
Needs	2
The Role of the Roadway Safety PCB Program	2
II. State of the Practice	
Introduction	3
Literature Review	3
Ongoing Initiatives	
Telephone Interviews	
Synthesis of Needs	
III. The Safety Workforce	
What is Highway Safety?	10
Who Does Highway Safety?	10
Defining the Safety Professional	
Degrees of Involvement	
Professions Commonly Involved in Highway Safety	12
Workforce Demographics	14
Future Workforce Trends	15
IV. Conclusion	16

Appendix: Literature Review



I. EXECUTIVE SUMMARY

The Federal Highway Administration's (FHWA) Office of Safety is creating a Roadway Safety Professional Capacity Building (PCB) Program. To better understand the potential audiences and their needs, staff at the John A. Volpe National Transportation Systems Center (Volpe Center) conducted telephone interviews with state departments of transportation (DOT) safety staff and performed a literature review. This work was supplemented with observations from the Transportation Research Board's (TRB) Highway Safety Workforce Subcommittee. A summary is included in this Preliminary Needs Assessment. This work led to the development of the *Roadway Safety Professional Capacity Building Program Plan*.

Findings

- 1. There are relatively few full-time safety professionals today. Highway agencies tend to promote the concept of "safety is everyone's job" and have very few positions that are explicitly devoted to safety. There are many more generalists than specialists working in safety and full-time safety professionals are few in number. While highway safety professionals who dedicate most of their work time to highway safety as such are few and far between, a wide variety of professions are involved in highway safety.
- 2. The number of these professionals is currently expected to decrease. The highway safety workforce is, on average, older than the transportation workforce as a whole, suggesting that the loss of institutional memory and experience may be particularly high in this profession. Many retirements are anticipated over the next 5 years.
- 3. Despite agencies' good intentions, dispersed resources and responsibilities hinder their ability to make safety a priority. As previously noted, safety responsibilities are typically spread through departments of transportation. It may be difficult for an agency to make safety a priority when no single staff member or department is "in charge of" highway safety. In addition, securing funding for safety work is a perennial challenge. Some interviewees noted that the distinction between routine maintenance and safety improvements is not always clear, and that safety funding does not always go to for its intended purpose.
- 4. Many agencies and organizations, both public and private, are working to improve highway safety in the United States. These efforts include the American Association of State Highway and Transportation Officials (AASHTO) Strategic Highway Safety Plan, TRB's Highway Safety Manual project, and numerous United States Department of Transportation (USDOT) initiatives.
- 5. Behavioral, vehicular, and roadway safety initiatives are often not coordinated and can be confusing. This coordination issue has emerged at the

program level, in interactions, or the lack thereof, between engineers, law enforcement officers, and educational professionals.

Needs

- **6.** Safety professionals need access to improved information and peer-to-peer communication to do their jobs better. These are the clear high-priority needs derived from interviews with safety practitioners. Good information exists, but access to it is varied. New tools and technologies are continually emerging, and safety professionals need training to make the best use of new resources.
- 7. The need for training and technology transfer will increase as the workforce composition changes. In light of expected retirements, coordinated training resources will be more important than ever. Training needs are highest for data collection and analysis. This is a field where technology and best practices are rapidly changing. Staff in local agencies, in particular, may have difficulty accessing and interpreting the data that is collected. Timely data input, good technical analysis, and effective use of the information obtained were particularly desired.

The Role of the Roadway Safety PCB Program

The Roadway Safety PCB Program is designed to help meet the high-priority needs of safety professionals, with a focus on improving workforce development through better information and communication. Future work will include an online clearinghouse of safety resources and ongoing assessment of the users' needs. The details of the strategy recommended by the Office of Safety can be found in the *Roadway Safety Professional Capacity Building Program Plan*.



II. STATE OF THE PRACTICE

Introduction

To better understand existing conditions in the field of highway safety, as well as the unmet needs of highway safety professionals, Volpe Center staff conducted a state of the practice review. The goal was to determine the general gaps between existing knowledge resources, resources recommended in the literature, and resources desired by practitioners.

Two methods, a literature review and a series of telephone interviews, were used. The focus of both was an overview of highway safety as a profession, rather than individual technical advances. The research clearly indicates a need for improved information dissemination and professional development resources.

Literature Review

Three themes emerged from the literature review:¹

- An emphasis on strategic planning;
- Transportation workforce demographic trends; and
- The importance of new analytical tools and technologies for highway safety.

Strategic Planning

There is a clear emphasis on strategic planning and the incorporation of multiple disciplines into the safety discussion. While the law no longer requires safety management systems, the literature emphatically supports strategic planning. The recommended measures include a new focus on corridor analysis instead of "black spot" analysis alone, and the development of multi-disciplinary teams for safety analysis.²

The Integrated Safety Management System (ISMSystem), developed to support the American Association of State Highway and Transportation Officials (ASHTO) *Strategic Highway Safety Plan*, is one example of the kind of strategic planning effort emerging from the literature. Another is FHWA's Safety Conscious Planning (SCP) initiative. It was introduced in response to new requirements in the *Transportation Efficiency Act for the 21*st *Century* (TEA-21) for consideration of safety in transportation planning conducted by metropolitan planning organizations (MPOs). Safety professionals need to understand the concepts behind strategic planning and to be able to work with professionals from other fields, such as transportation planners, educators, the media, and law enforcement officers. The *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU) now requires comprehensive highway safety plans.

¹ The literature review in its entirety can be found in the Appendix.

² Black spots are also known as hot spots – intersections or locations with a high concentration of accidents.

Workforce Demographics

Analysis of workforce demographics for transportation agencies suggests that a wave of retirements is about to begin as the Baby Boomer generation reaches retirement age. The safety workforce, in particular, was found to consist of older-than-average employees.³ Moreover, the pool of potential applicants is smaller than in the past, as the focus of many engineering students has shifted to computer and software engineering. In addition, competition for potential applicants from private firms, with generally higher pay, is stiff. The potential for loss of institutional memory is also high and indicates a need to begin formalizing training rather than relying on on-the-job training.

New Tools and Technologies

As a field, transportation engineering has been moving away from "one size fits all" standards and towards a better understanding of local conditions. In the past, highway safety staffs relied upon universal standards and professional experience. Today, the field is benefiting from the development of new analytical tools and technologies for highway safety. With new tools, however, comes a need for new skills and new training resources to provide those skills to the safety workforce. Safety professionals need to understand these technological advances in order to take advantage of them.

FHWA's 2001 national review of the Highway Safety Improvement Program found the following best practices:⁴

- Have safety as a major goal of the agency, with commitment to it at the highest levels.
- Have a good multi-disciplinary safety management process in place, with a strong component for roadway safety.
- Emphasize safety on all projects.
- Have a Safety Engineer / Coordinator, a designated safety division, or both within the state department of transportation as the focal point for safety activities.

These themes, identified during the national review, were echoed in the interviews and throughout the literature.

Ongoing Initiatives

The literature review identified several continuing efforts that are relevant to the development of a Roadway Safety Professional Capacity Building Program. These efforts will be monitored and the results of this work incorporated as appropriate.

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³ TRB Special Report 275: The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies. Washington, D.C.: TRB 2003.

⁴ Office of Corporate Management, Safety Core Business Unit, FHWA. National Review of the Highway Safety Improvement Program. November 2001.

AASHTO Strategic Highway Safety Plan

The AASHTO Strategic Highway Safety Plan outlined two major initiatives for the improvement of highway safety: the widespread utilization of proven strategies and the initiation of model deployment and demonstration efforts.⁵ The plan, originally published in 1998, has been reaffirmed and republished.

The plan is being implemented through the National Cooperative Highway Research Program (NCHRP) Project 17-18(3). Implementation guides for state and local agencies are being written for each of the 22 key highway safety areas. The project is being phased: 13 of the implementation guides have been completed and the remaining 9 are underway.

Development of a Highway Safety Manual

TRB is sponsoring the development of a Highway Safety Manual to serve as a companion to the widely-used Highway Capacity Manual. This project is ongoing. A report on developing the outline of, and work plan for, a Highway Safety Manual, including an annotated outline and a prototype chapter, has been submitted to NCHRP. The Highway Safety Manual "will transmit a majority of the best known factual information about the effects of roadway planning, design and operations decisions on safety."

FHWA Tools and Technologies

FHWA is sponsoring the development of two software packages for highway safety. SafetyAnalyst is a tool for identifying sites for improvement and developing site-specific highway safety improvements. The Interactive Highway Safety Design Model (IHSDM) is a decision-support tool for the highway design process. The 2003 release of the IHSDM has the capability to analyze two-lane rural highways. More sophisticated capabilities will be added in the future.

Curricula Development Initiatives

Multiple organizations have sought in recent years to develop curricula appropriate for development of professionals in the highway safety fields. At the time of writing, these projects are ongoing and the curricula are not yet finalized:

- Transportation Curriculum Coordinating Council (TCCC)
- TRB Subcommittee on Highway Safety Workforce Development
- NHTSA Core Competencies

SAFETEA-LU

After the literature review had been completed, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was enacted August 10,

⁵ See Appendix for more information.

⁶ NCHRP Web Document 62 (Project 17-18[4]): Contractor's Final Report. *Development of a Highway Safety Manual*. March 2004.

2005. It brings with it new opportunities and challenges for highway safety. As indicated in the title, safety is now a core program area. The legislation clarifies that Surface Transportation Program (STP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), and other common Federal funding sources may be used for education and workforce development, which may help agencies to prioritize training in their budgets. Research and technology deployment funding, however, which is frequently used for technology transfer and training, is constrained by the number of prescribed high-priority projects.

Telephone Interviews

In order to better understand the challenges and opportunities in highway safety as practiced today, Volpe Center staff conducted phone interviews with 13 highway safety professionals in 10 states. The telephone interviews took place between February and April 2004. The interviewees were all state DOT employees, whose jobs were primarily, if not wholly, devoted to safety. Interviewees were chosen based on recommendations from their peers and FHWA staff. Interview results were summarized and analyzed to uncover common issues.

Interviewees all worked at the state DOT headquarters for their state, many in a traffic operations department. Responsibilities were wide-ranging. Many interviewees were deeply involved in managing highway design and day-to-day operations, while others were more focused on policy decisions and grant administration. Other duties included providing technical support to their district field staff; maintaining the state Manual on Uniform Traffic Control Devices (MUTCD); maintaining, analyzing, and distributing crash data; making programming decisions for safety funds; and project evaluation. Interviewees indicated that they frequently interacted with law enforcement, marketing, and education professionals in addition to district and local engineers.

Major Issues

Interviewees identified five major issues that affected their work in improving highway safety as follows:

1. Safety as a collateral duty

Interviewees had difficulty answering a question that asked if inadequate professional development contributed to existing problems in highway safety. Most were reluctant to agree, because doing so would constitute an inherent criticism of their colleagues. Many answered by saying that "safety is everyone's job" or that there are no safety-specific professionals or training. There is clearly a shortage of people who have adequate training and expertise in roadway safety. One interviewee noted, "People do 4-5 types of jobs – such as signals and signing. [They] may not be exposed to the most recent research [and] best practices because they're too busy." This lack of focus likely has consequences throughout the organization.

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⁷ Volpe Center interviewee, 2004.

2. Lack of coordination between "hard" and "soft" sides

Interviewees repeatedly noted differences between the engineering approach to safety improvement – the "hard side" – and the behavioral approach – the "soft side." This was frequently manifested in the context of FHWA policies and programs and NHTSA policies and programs. Multiple interviewees noted that NHTSA provides more direction and guidance through its administration of grant programs. This coordination issue also emerged at the program level, in interactions, or the lack thereof, between engineers, law enforcement officers, and educational professionals.

3. Data collection and analysis

Interviewees stressed the importance of good data collection and analysis. They expressed concerns, however, that good practice may not be widespread, and that local agencies may have difficulty accessing and interpreting the data that is collected. Interviewees particularly desired timely data input, good technical analysis, and effective use of the information obtained. Suggestions for improvement were generally related to higher funding levels, dissemination of best practices, and training for those in the field.

4. Making safety a priority

Interviewees reported difficulty in winning over policymakers and the public on the need for safety improvements. Successful safety improvements may be "invisible" to the public, as success is defined by a non-event: no accidents. Practitioners need to convince the politicians, the public, and agency management that investment in safety is necessary.

Within state DOTs, a lack of focus on safety sometimes led to difficulty in committing designated safety funding to high-priority safety needs. Interviewees desired an organizational focus on safety, both in state DOTs and in local jurisdictions. They wanted improved data collection to show the need for, and effectiveness of, safety improvements and the development of a safety culture within the organization.

5. Funding

A fifth issue, funding, was also identified. Interviewees stressed that the overall quantity of funding was insufficient. They also had difficulties in properly obligating the safety funding they did receive. The former problem is outside the scope of the RSPCB Program and is merely noted here. The latter problem seems to be part of a larger issue - making safety a priority within the agency.

High-Priority Needs

The current issues identified previously cannot be overcome solely with existing resources. When asked what additional resources they need to better perform their jobs (besides funding), better information was the clear answer. Generally, interviewees cited the state's FHWA Division Office Safety Engineer as a respected and valued resource. They noted, however, that they would like more information on best practices and

improved channels for peer-to-peer communication. Peer exchanges, listservs, online clearinghouses, and regional conferences were all suggested.

Additionally, practitioners desired improved data collection and analysis tools, and the training to better use them. With better tools and training, the identification of high-priority sites, the selection of treatments and programs, and the evaluation of remedies could all be improved.

Future Trends

A few interviewees noted that problem drivers – aggressive, older, distracted, those driving while impaired – were currently an issue and many noted that they will become more so in the future.

New technologies, such as automated enforcement, global positioning systems, and intelligent transportation systems, were considered to have potential positive and negative impacts. Interviewees look to the Federal government for research and analysis on these emerging technologies and trends.

Synthesis of Needs

When comparing the results of the literature review with the telephone interviews, three issues emerged:

- 1. Safety professionals need access to improved information and peer-to-peer communication to do their jobs better. These are the clear high-priority needs derived from interviews with safety practitioners. Good information exists, but access to it is varied. New tools and technologies are continually emerging, and safety professionals need training to make the best use of new resources.
- 2. The need for training and technology transfer will increase as the workforce composition changes. In light of expected retirements, coordinated training resources will be more important than ever. Alarmingly, interviewees are concerned that there are not enough safety professionals today. If the workforce demographic trends identified in the literature review come to fruition, this could have serious consequences for the safety workforce.
- 3. **Training needs are highest for data collection and analysis.** The field is advancing and new tools are under development. Highway safety professionals will need training to get the most out of these new resources. Staff at local agencies, in particular, may have difficulty accessing and interpreting the data that is collected. Timely data input, good technical analysis, and effective use of the information obtained were particularly desired.

Four topic areas were identified where new tools and training were desired:

- 1. Collection, analysis, maintenance, and dissemination of accident data;
- 2. Identification of high-priority sites and corridors;
- 3. Choosing appropriate countermeasures; and
- 4. Evaluating countermeasures once in place.

Finally, resolving the lack of coordination between multiple disciplines working to advance highway safety, which was noted by interviewees, seems to be a major driver behind the various strategic planning initiatives underway today. It remains to be seen, however, if the strategic planning supported in the literature will be mainstreamed into contemporary practice.

III. THE SAFETY WORKFORCE

A goal of this study was to better understand the safety workforce and its needs. A discussion of the profession of highway safety and its practitioners helps place this project in context.

What is Highway Safety?

Highway safety is the condition under which physical factors and human behavior in relation to the use of public roadways are conducive to the avoidance of crashes that may result in loss of life, injury, and/or property damage. Practically speaking, highway safety is a goal, rather than an achieved state, at this time. Statutes and agency goals talk about highway safety as "reduction in injury, loss of life, and property damage." In principle, however, crashes – all crashes – should be avoidable.

Many factors contribute to crashes. These factors take numerous forms and are often interrelated:

- Crashes may be due to roadway conditions that are themselves the result of multiple contributing factors: engineering design, maintenance, signage and marking (or their absence), adverse weather conditions, work zones, temporary changes due to accidents (collisions, spills, rollovers), and so forth.
- Crashes may involve one or more users of a roadway: a vehicle driver, a passenger, a pedestrian, and/or a bicyclist.
 - O The vehicle may be a private car, van, a motorcycle, light truck, a commercial truck of any size, a school bus, a transit bus, a taxicab, or a train if the collision occurs at a highway-rail intersection.
 - The driver of the vehicle may be a private citizen, a commercial driver, or a driver of a public transportation vehicle.
 - o Passengers in the vehicle may contribute to a crash, suffer its consequences, or both.
 - o Pedestrians and cyclists may be the cause of a crash, the victims, or both.

The field as a whole, often referred to as "highway safety" in America, includes driver behavior, vehicular safety, and the safety of the physical infrastructure, often referred to as roadway safety. Safety is also addressed by several fields, as discussed below.

Who Does Highway Safety?

In some way, everyone whose professional duties impact individuals, vehicles, and the environment is a contributor to highway safety. This is not to say, however, that highway safety represents the whole, or even the bulk, of their jobs. It is important to understand that while highway safety professionals who dedicate most of their work time to highway safety as such are few, a wide variety of professions are involved in highway safety.

Defining the Safety Professional

Is the safety professional one whose job is fully or mostly devoted to safety?

The United Kingdom's Institution of Highways and Transportation defines the practice of safety engineering as follows: "Expertise in safety engineering is recognized as a combination of competence in techniques of accident investigation and remedial design, and underpinning knowledge of safety principles and relevant practice."8

Highway safety engineering as an independent discipline is comparatively unknown in the United States. There are few university courses on highway safety, and fewer still departments offering safety engineering as a concentration. Formal processes to certify and encourage safety, such as road safety audits and road safety commissions, are also less common in the United States, which may contribute to this issue. Highway safety continues to be a profession dominated by generalists, or specialists in other fields.

If there are no safety engineers in America, who is doing highway safety?

In highway safety circles, the "3 E's" has long been shorthand for engineering, education, and enforcement: the three professions that tend to deal directly with creating a safer highway environment. In recent years, a fourth profession, emergency response services, has been added to the list in recognition of the critical role they play once an accident has occurred. Together, these four professions represent a majority of the highway safety professionals.

Not all members of these professions interact with highway safety. Of those who do, relatively few are in positions that have explicit highway safety duties.

As discussed in Section II, a series of telephone interviews conducted from February to April 2004 covered professional development and the safety professional. The primary finding on the topic was that highway agencies tend to promote the concept of "safety is everyone's job" and have very few positions that are explicitly devoted to safety. Consequently, there are many more generalists than specialists working in safety, and full-time safety professionals are few in number.

There are both advantages and disadvantages to having highway safety spread throughout an organization. To achieve a safe highway environment, the participation of planners, designers, engineers, construction workers, maintenance staff, law enforcement, drivers, and countless others is required.

One interviewee stated that "good traffic engineering is good safety engineering – they're one and the same." When safety is everyone's responsibility, however, it can effectively become no one's responsibility. Another interviewee noted that safety "falls through the cracks sometimes....there's no safety champion." Many planners, designers, and engineers directly impact highway safety in the course of their

⁸ http://www.iht.org/

⁹ Volpe Center telephone interviews, 2004.

¹⁰ Volpe Center interviewee, 2004.

¹¹ Volpe Center interviewee, 2004.

professional duties and are told to consider safety as a factor in all of their decisions. Safety, however, is not a tangible product. It is difficult to show improvements without formalized evaluation procedures, which are uncommon in the United States. It may be difficult for an agency to make safety a priority when no single staff member or department is "in charge of" highway safety.

Degrees of Involvement

Professional involvement in highway safety can be generally divided into three groups, referred to here as dedicated, collateral, and policy/other. Only members of the first group are likely to consider themselves highway safety professionals. Primary actors, defined here as those whose positions are entirely or largely dedicated to safety responsibilities, are relatively few and far between. They may be actively involved in highway safety research, leading safety education efforts, or heading up safety advocacy groups.

Members of the second group also directly impact safety in the course of their duties. However, while they must keep safety considerations in mind in the course of their duties, safety is not the focus of their work. Members of this group are unlikely to consider themselves safety professionals and include highway designers, engineers, and others.

Members of the third group have only an indirect impact on the highway safety environment through performing their jobs, but it may be a disproportionately large one. The impact of funding decisions made by politicians, or of sentencing decisions made by the judiciary, falls into this category.

Typical Involvement in Safety Activities						
Dedicated Collateral Policy / Other						
Degree of Involvement	Full-time	Part-time	Occasional			
Typical Professions	Researcher, advocate, grant administrator	Highway or traffic engineer	Elected officials, the judiciary, agency management			
Impact	Direct	Direct	Indirect			

All three of these groups impact the safety of our nation's roadways. Members of the second and third groups, however, may not be fully conscious of the impact of their actions. If they are working at full capacity to perform their existing duties, they may find it difficult to make safety considerations a priority. The degree of involvement in safety activities is one way that the Office of Safety can prioritize its audience, but to effect change, education for those with part-time but direct impact may prove important.

Professions Commonly Involved in Highway Safety

The three primary components of highway safety are the roadway, the vehicle, and the user. Some professions may focus on only one of these components, while others may focus on two or more. The academic and professional backgrounds of these professionals may be quite different and include engineering, education, media, psychology, medicine,

and others. The major fields and employers involved in highway safety are identified in the next two tables. Traditionally, FHWA's role has been most closely aligned with the roadway and research fields.

Major Fields in Highway Safety				
Research	Roadway			
Engineering Physiology Psychology Human Factors	Engineering Highway Design Transportation Planning Construction Maintenance			
Emergency Response	Policy			
Medicine Law Enforcement Fire and Rescue	Public Policy Law			
Enforcement	Outreach and Education			
Criminal Justice Law	Media Public Relations Education			

Major Employers in Highway Safety			
Research	Roadway		
NHTSA	Local, State, and Federal DOTs		
Universities	Local DPWs		
Research Centers	Private Consulting Firms		
Insurance Institute for Highway Safety	MPOs		
Auto Manufacturers	City Planning Offices		
Emergency Response	Policy		
	Federal Agencies		
	■ FHWA		
	■ NHTSA		
	■ FMCSA		
	■ FRA		
Hospitals	■ FTA		
Police and Fire Departments	State Agencies		
	 Governor's Office 		
	 State DOT 		
	Local, State, and Federal Elected Bodies		
	State, County, and Municipal Courts		
	Advocacy Groups		
Enforcement	Outreach and Education		
Departments of Motor Vehicles	Departments of Motor Vehicles		
Judiciary	State and Local Police		
Local and State Police	Governor's Office		
Highway Patrol	State DOTs		
FMCSA	Advocacy Groups (MADD, AARP, etc)		
FRA	Universities		
	Health Departments (Local, State, Federal)		

Another way of understanding the role of the highway safety workforce is by using a Haddon Matrix, developed by epidemiologist William Haddon, Jr. In traffic safety, Haddon analysis examines human, vehicle, and environmental factors before, during, and

after the event, with a focus on prevention. The Haddon Matrix can be used to get an idea of where roles and responsibilities lie during the different phases of an event.

Haddon Matrix and Responsibilities					
FACTOR		Vehicle	Environment		
PHASE	Human		Physical	Social	
Pre-Event	Licensors Regulators Educators Public relations Researchers Parents and friends	Licensors Regulators Auto designers Auto manufacturers Researchers	Planners Engineers Technicians	Citizens Elected and appointed officials	
Event		Call center operator			
Post-Event	Responders Law enforcement Public works crews Investigators Researchers Judiciary Medical staffs	Investigators Researchers Tow truck operators	Investigators Public works crews Researchers	Citizens Elected and appointed officials	

A professional capacity building program must define which members of these potential audiences are its primary customers and stakeholders. Conclusions from the literature review and interviews indicate that the traditional FHWA stakeholders – those working in the physical roadway environment – have unmet needs which should be addressed.

Workforce Demographics

Given the wide range of disciplines involved in highway safety, it is not surprising that educational levels range from high school to graduate school. There are few in the field with formal safety engineering training. Some local and state agencies may find themselves with traffic engineers who lack even traffic engineering training. One interviewee noted that, at the division level for his agency "the traffic engineers are general engineers, not specifically trained [in transportation] and learn mostly on the job." This may be especially true for city and county engineers, who are often required to be "jacks-of-all-trades."

In order to assess how and what kinds of resources and topics should be the target of training safety transportation professionals, FHWA conducted a survey of the Federal, state, and local government staff members and the academic community in August of 2002. Staff members from 50 FHWA division offices, 9 state DOTs, the Local Technical Assistance Program community, and members of academia responded to the survey.¹³

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¹² Volpe Center interviewee, 2004.

¹³ Leiphart, Kristine and Chimai Ngo. *Results from a Safety Survey: Workforce Development for Transportation Professionals*. http://safety.fhwa.dot.gov/media/ressurvey.htm.

Respondents: "Workforce Development for Transportation Professionals" Survey						
Audience	Respond- ents	Years in Transport- ation	Years in Safety	Age	Degree	Roles
FHWA	151	Over 50% with >20 years	100% with 5 or less years	65% between 31-50	61% College 34% Graduate	77% Engineers 15% Managers
State	34	~25% with 10+ years	71% with <3 years	64% between 31-50	61% College 34% Graduate	47% Engineers 35% Managers
Local	9	Evenly split: 5-10 years, 10-20 years, and >20 years	45% with >20 years 33% with 6-10 years	N/A	36% College 50% Graduate	36% Engineers 50% Managers
Total	194					

Future Workforce Trends

The transportation workforce is predicted to experience high levels of retirement as the Baby Boomer generation ages out of the workforce. Small civil engineering classes and competition with the private sector and other fields are likely to produce a smaller, less experienced group to take their place. One study found that the highway safety workforce is, on average, older than the transportation workforce as a whole, which suggests that the loss of institutional memory and experience may be particularly high in this profession. ¹⁴

This loss of highway safety personnel has already begun at some agencies. One interviewee noted that his agency had "lost a lot of experience through early retirement programs. There are no safety professionals." ¹⁵

This loss of experience comes at a time when new tools and technologies are being developed. In a presentation at the April 2002 Highway Safety Workforce Planning Workshop, Dr. Ezra Hauer spoke on the implications of current trends in highway safety. "First, the future road safety workforce will extend to additional layers of professionals. Second, the future road safety workforce will have to master the extant and expanding body of fact based knowledge and do so by training before entering practice, not on the job." It is clear that additional training resources will be necessary to support this century's transportation safety workforce.

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¹⁴ TRB Special Report 275: The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies. Washington, D.C.: TRB 2003.

¹⁵ Volpe Center interviewee, 2004.

¹⁶ http://members.rogers.com/hauer/Pubs/WorkforcePlanning.pdf.

IV. CONCLUSION

In summary, the safety workforce is small and is expected to shrink further, the technologies are changing rapidly, and a strong need exists for improved information dissemination and peer-to-peer communication to inform and train the existing and the future workforce.

Interviewees identified four main areas in which the Federal government could help:

- Research
- Information dissemination
- Outreach and education
- Oversight and guidance

Because practitioners across the country need the same types of information and have identified some common knowledge and training gaps, a Federally sponsored safety PCB program is necessary in order to help leverage small operating budgets. With a broad perspective across all 50 states, a PCB program can help connect people who work on safety to each other and to the information they need to perform their jobs more effectively, such as recent research that incorporates the latest state of the art.

The Roadway Safety PCB Program shall be designed to help meet the high-priority needs of safety professionals, with a focus on improving workforce development through better information and communication. Future work will include an online clearinghouse of safety resources and ongoing assessment of the users' needs.

The details of the strategy recommended by the Office of Safety to address this preliminary needs assessment can be found in the *Roadway Safety Professional Capacity Building Program Plan*.



APPENDIX: Literature Review

APPENDIX: LITERATURE REVIEW

A review of the highway safety planning literature was conducted in September 2004.

Three themes emerged from the literature:

- 1. An emphasis on strategic planning;
- 2. Transportation workforce trends; and
- 3. The importance of new analytical tools and technologies for highway safety.
- 1. There is a clear emphasis on the need for strategic planning and the incorporation of holistic measures to address roadway safety. While the law no longer requires safety management systems, the literature supports strategic planning. The holistic measures include a new focus on corridor analysis instead of "black spot" analysis alone and the development of multi-disciplinary teams for safety analysis. Safety professionals need to understand the concepts behind strategic planning and to be able to work with professionals from other fields.
- 2. Analysis of workforce demographics for transportation agencies suggest that a wave of retirements will begin as the Baby Boomer generation reaches retirement age. There is a smaller pool of potential applicants and competition from private firms, with generally higher pay, is stiff. The potential for loss of institutional memory is also high and indicates a need to begin formalizing training rather than relying on on-the-job training.
- 3. Highway safety is gradually becoming a science-based field. There are new tools and analysis methods being developed every day. Safety professionals need to understand these advances in order to take advantage of them.

Annotated Bibliography

The following sources were used in the literature review for the preliminary needs assessment. Key points are noted.

Background Materials

FHWA's Vital Few Priorities

http://www.fhwa.dot.gov/whoweare/whoweare.htm

- Safety
- Congestion Mitigation
- Environmental Stewardship and Streamlining

NHTSA, National Crash Statistics.

http://www.nhtsa.dot.gov/portal/site/nhtsa

Crash data for 2003 show slight decreases in the overall number of people killed or injured in traffic accidents as well as the fatality rate. Fatalities and injuries for individual groups, such as motorcycle riders and trucks, increased.

Ostensen, A. George. "Saving Lives: A Vital FHWA Goal." *Public Roads*, July/August 2003.

This article details the safety component of the FHWA's Vital Few goals. The key performance measure is lives saved, with a focus on reducing fatalities at intersections, of pedestrians, and in run-off-the road accidents.

6 National Strategies:

- Encourage the implementation of strategic safety programs
- Protect vehicle occupants
- Prevent roadway departures
- Minimize the consequences of roadway departures
- Conduct comprehensive intersection analyses
- Foster a systematic approach to community safety

Strategic Planning

AASHTO. Strategic Highway Safety Plan. 1998, Rev December 2004.

http://safety.transportation.org/plan.aspx

The AASHTO Strategic Highway Safety Plan outlined two major initiatives for the improvement of highway safety: the widespread utilization of proven strategies and initiation of model deployment and demonstration efforts. The plan, published in 1998, was designed to be implemented over 5-7 years, ending in 2004.

The plan includes 6 Elements:

- Drivers
- Special Users
- Vehicles
- Highways
- Emergency Medical Services Management

And 22 Goals:

- Goal 1: Instituting Graduated Licensing for Young Drivers
- Goal 2: Ensuring Drivers are Fully Licensed and Competent
- Goal 3: Sustaining Proficiency in Older Drivers
- Goal 4: Curbing Aggressive Driving
- Goal 5: Reducing Impaired Driving
- Goal 6: Keeping Drivers Alert
- Goal 7: Increasing Driver Safety Awareness
- Goal 8: Increasing Seatbelt Usage and Improving Airbag Awareness
- Goal 9: Making Walking and Street Crossing Safer
- Goal 10: Ensuring Safer Bicycle Travel
- Goal 11: Improving Motorcycle Safety and Increasing Motorcycle Awareness
- Goal 12: Making Truck Travel Safer
- Goal 13: Increasing Safety Enhancements in Vehicles
- Goal 14: Reducing Vehicle-Train Crashes
- Goal 15: Keeping Vehicles on the Roadway
- Goal 16: Minimizing the Consequences of Leaving the Road
- Goal 17: Improving the Design and Operation of Highway Intersections
- Goal 18: Reducing Head-on and Across-median Highway Crashes
- Goal 19: Designing Safer Work Zones
- Goal 20: Increasing Emergency Medical Capabilities to Increase Survivability
- Goal 21: Improving Information and Decision Support Systems
- Goal 22: Creating More Effective Processes and Safety Management Systems

The project is being implemented through NCHRP Project 17-18(3): Implementation guides for state and local agencies are being written for each of the 22 key highway safety areas. "Each guide includes a brief introduction, a general description of the problem, the strategies/countermeasures to address the problem, and a model

implementation process." The project is planned in three phases: Phase I, which included the first six guides, is complete and Phase II is ongoing.

While all of the 22 key highway safety areas have implications for workforce development, none of the key areas explicitly focus on training or workforce issues. Goal 22 - Creating More Effective Processes and Safety Management Systems – is probably the most relevant. It recommends community-based multi-disciplinary coalitions for developing safety management systems, planning, and the development of a national agenda.

AASHTO - NCHRP Project 17-18. Lifelines. Vol. 1, No. 2. July 2004.

http://safety.transportation.org/lifelines.aspx

AASHTO-published newsletter on the ongoing Strategic Highway Safety Plan project. "The highway safety goal for the United States as a whole is a reduction in the fatality rate to no more than 1 per 100 million vehicle miles traveled. The death rate for several years has remained constant at 1.5" (1).

Bower, Dwight et al. Managing and organizing comprehensive highway safety in Europe. Washington, D.C.: U.S. Dept. of Transportation, Federal Highway Administration, Office of International Programs, 2003.

http://international.fhwa.dot.gov/pdfs/pl03006.pdf

The International Technology Scanning Team participants visited the United Kingdom, Germany, Sweden, and the Netherlands. The dominant theme of the report is the importance of taking a holistic approach to highway safety. The nations profiled used multi-disciplinary safety teams and had moved or were moving to a corridor approach rather than a "black spot" approach in identifying high-priority locations for safety improvement.

Common themes of countries visited:

- Highway safety is viewed as a public health or quality of life issue.
- There is a focus on comprehensive and coordinated safety plans and goals.
- They stress highway safety support activities (such as data collection and analysis).

Depue, Leanna. NCHRP Synthesis 322: Safety Management Systems: A Synthesis of Highway Practice. Washington, D.C.: Transportation Research Board, National Research Council, 2003.

This synthesis provides a legislative history of Safety Management Systems (SMS) and the results of a 2002 survey of SMS in states. While there are some suggestions for training and peer exchange, the focus here is on the components of a good SMS.

In 2001, 26 states reported having an active SMS. The 2002 survey found that number had dropped to 15.

Iowa's SMS has both public and private representation and includes 4 Es + 1 of highway safety: engineering, enforcement, education, and emergency response plus everyone else. (19)

Office of Corporate Management, Safety Core Business Unit, FHWA. National Review of the Highway Safety Improvement Program. November 2001.

This program review focused on identifying and disseminating best practices for the Highway Safety Improvement Program. An FHWA review team visited six states (Delaware, Oregon, Connecticut, Florida, Ohio, and Iowa) between February and April, 2001.

2001's National Review of the Highway Safety Improvement Program found the following best practices:

- Having safety as a major goal of the agency, with commitment to it at the highest levels.
- Having a good multi-disciplinary safety management process in place, with a strong component for roadway safety.
- Emphasizing safety on all projects.
- Having a Safety Engineer / Coordinator and/or a designated safety division with the state department of transportation as the focal point for the HSIP.

Each Florida DOT District Office has a safety engineer, a law enforcement liaison and Community Trade Safety Team Coordinators.

Workforce Issues

Committee on Future Surface Transportation Agency Human Resources Needs: Strategies for Recruiting, Training, and Retaining Personnel. *TRB Special Report 275: The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies.* Washington, D.C.: TRB 2003.

This report outlines the challenges facing the transportation industry - heavy retirements, smaller pool of candidates, expanded responsibilities – and suggests some strategies for addressing them. Expanding the role of strategic human resources planning and training are the major recommendations. The ITS PCB Program is cited as a model of innovative training. Other topics include data needs, the impact of widespread use of contractors, and encouraging alternative paths to transportation.

Findings: 5 Key Issues:

• The transportation workforce requires a wider range of skills and abilities than in the past because of changing and expanding agency missions as well as new

- technologies; this has coincided with level or decreasing staffing in transportation agencies.
- Transportation agencies face an unprecedented level of retirements of senior-level managers over the next decade – nearly double the rate for the nation's entire workforce.
- The agencies are significantly under investing in training their workforces.
- The agencies are finding it increasingly difficult to recruit and retain professionals and technicians. (6-1)

Recommendations:

- Transportation agencies at all levels...should establish training as a key priority.
- Surface transportation agencies should invest more in training than is currently the case.
- More federal surface transportation program funds should be eligible for use by state and local transportation agencies for training and education activities.
- USDOT...[with partners]...should undertake an initiative that focuses on innovation in human resource practices and addresses recruitment, training, retention, and succession management for transportation agency personnel.
- Transportation agencies should partner with universities, community colleges, training institutes, and the LTAP centers to meet agency training and workforce development needs.
- Transportation agency leaders should make human resource management a key strategic function of their agencies. (6-4-6-8)

"Proceedings of the Highway Safety Workforce Planning Workshop" FHWA. FHWA-SA-02-004.

The Highway Safety Workforce Planning Workshop brought together policy experts, academics, and safety officials to discuss the future of the highway safety workforce in April 2002 in San Antonio, TX.

Professional development and workforce planning were key topics at the workshop and participants "suggested a central source for housing all of the training information" (6).

Many of the recommendations pointed to the establishment of a Roadway Safety PCB Program:

- Develop a national clearinghouse to comprise the information and data that would reflect the training, conference and professional development opportunities for the roadway safety community.
- Develop cooperative safety training with professional societies, universities, Local Technical Assistance Program (LTAP) centers, administrations within the U.S. Department of Transportation (USDOT), consultants and others. (7)

Hauer, Ezra. "Workforce for Road Safety Management." Transcript of presentation given to the Highway Safety Workforce Planning Workshop, April 2002.

http://ca.geocities.com/hauer@rogers.com/download.htm

Dr. Hauer reiterates the need for a science-based understanding of highway, or, to use his term, road safety. He touches on implications for the future safety workforce.

"First, the future road safety workforce will extend to additional layers of professionals. Second, the future road safety workforce will have to master the extant and expanding body of fact based knowledge and do so by training before entering practice, not on the job" (1).

"In sum, workforce planning should be shaped by two principal trends: by the broadening of the workforce that is in need of road safety training, and by increased reliance in training on accumulated factual knowledge and research" (7).

Knapp, Keith, Donald Walk, Eugene Wilson. Challenges and Strategies for Local Road Safety Training and Technology Transfer. FHWA, 2002.

http://safety.fhwa.dot.gov/training/challenges.htm

"In 1998 approximately 39 percent (or 16,010) of all the fatalities that occurred in the United States were along roadways classified as collector or local streets" (Knapp 2).

The authors stress the importance of addressing local roads and local knowledge in outreach and training activities. In general, working through existing programs, especially LTAP, is recommended.

Challenges:

- Raising safety awareness of local officials
- Acknowledgement of current workload
- Funding sources

"There should be a determination of whether their experience or knowledge allows them to understand the availability and use/analysis of safety data in the jurisdiction, the identification and prioritization of locations of safety concerns, the wide range of successful solutions that might be available, and the evaluation processes to determine the expected impact of those solutions" (Knapp 3).

"A significant challenge, however, will be encouraging local staff to attend safety courses or read safety-related documents. In most cases these people have many tasks and a limited amount of time. They need to be made aware of the problem and convinced or motivated that they can do something about it." (Knapp 6).

Leiphart, Kristine Lee. "Pushing Through the Safety Plateau". *Public Roads*, July/August 2003.

The theme of this article is that an investment in human capital is necessary to reduce the annual number of fatalities. The large number of employees reaching retirement age "is expected to lead to a large turnover, which will increase training needs within a short period of time" (39).

Leiphart, Kristine. Professional Excellence For Highway Safety Program (PE-HSP): Towards Organizational and Program Quality for U.S. DOT, 2002.

Internal Office of Safety document which suggests a plan for highway safety workforce development.

Martin, Clark. "HELP WANTED – Meeting the Need for Tomorrow's Transportation Work Force." *Public Roads*. July/August 2001.

This article outlines projected trends in the transportation workforce: high levels of retirement as Baby Boomers age out of the workforce, a smaller, less experienced and more mobile workforce to take their place. The article notes current initiatives to attract, train, and retain transportation workers.

"Training and professional development, always an important element of work force development, is going to play an even greater role as younger, less experienced workers move into the work force and as current employees assume greater responsibility as managers retire"(7).

New Tools and Analysis

Hauer, Ezra. Observational before--after studies in road safety: estimating the effect of highway and traffic engineering measures on road safety. Oxford, OX, U.K.; Tarrytown, N.Y., U.S.A.: Pergamon, 1997.

Frequently-cited monograph on evaluating highway engineering measures. A good example of the progression of highway safety from an art to a science.

Institute of Transportation Engineers. *The Traffic Safety Toolbox: A Primer on Traffic Safety.* Washington, D.C: Institute of Traffic Engineers, 1999.

This is an update of an early 1990s document. The middle chapters provide information on standards and state-of-the practice in topic areas ranging from geometric design to traffic calming to traffic enforcement, while the beginning and ending chapters treat safety more holistically. The more relevant chapters are highlighted below and excerpts from others are included. Many quotes point to the need for a Roadway Safety PCB.

Overview – Ezra Hauer

In his overview, Ezra Hauer discusses the conflicts between the two primary goals of traffic engineering: safety and efficiency. He deplores the common attribution of accidents to "human error", noting that although engineering decisions may be further removed from the immediate incident, they can more easily be altered to increase safety. He further develops two components of safety: nominal and substantive safety. The former refers to "conformance with standards, warrants, and design procedures;" the latter refers to the number of accidents and their severity. (xiv) "Nominal safety may be only weakly related to substantive safety." (xiv)

"Our professional standards and warrants demonstrate a great deal of concern for safety, but these very standards are too rarely based on a defensible knowledge of facts." (xii)

"The profession and its institutions seem to be content to let loose on the road system engineers who have not received training in road safety at the undergraduate level, and allow them to build roads and control traffic without requiring the acquisition of knowledge in road safety during their career. If knowledge is not in demand, it will not come into being. With resolve, the ITE can bring about change. (xvi)

Chapter 1: Safety Management, Thomas E. Boyer

Safety management systems can be developed at federal and state levels. Boyer states the realm of a federal program would be research, technical guidance to states, recommendations for national legislation, and interaction with automotive industry. In this chapter, he outlines the steps to take in forming a statewide safety management system, including considerations for stakeholders, effective collection and analysis of data, determining areas of concern and possible strategies, and plan development, implementation, and evaluation.

The three key components of Boyer's model safety management system:

- 1. Coalition-building
- 2. Possessing a common goal
- 3. Effective processes

"Key Characteristics of an effective management system:

- 1. Added emphasis to existing, cost-effective safety strategies, such as occupant protection and reduced drinking and driving.
- 2. Enhancements to improve the effectiveness of some existing programs, such as those targeting community safety programs, emergency medical services, and public safety knowledge and awareness.
- 3. New emphasis on major and emerging safety categories such as young, problem, older, and aggressive drivers...; vehicle safety enhancements; and new highway safety initiatives designed to keep vehicles on the road and minimize the consequences of leaving the road."

Chapter 2: Traffic Planning, Olof Gunnarsson

Three basic strategies to increase safety: 1) Exposure control – "reduce transport demand and the amount of total traffic." 2) Accident-risk control – "eliminating, reducing, or detecting risks of severe incidents and accidents for a given transport demand." 3) Injury control – "preventing or greatly reducing the consequences of a traffic crash."

Chapter 23: Teaching Safety, Eugene M. Wilson

List of national safety training resources. State/Local training resources, focus on LTAP. "Regular safety training is a necessary and beneficial activity. It is recommended that training be reinforced and that time and financial resources be budgeted for development of an effective training program. Funding of safety training is the best money that a traffic agency will spend."

Chapter 29: Road Safety Audit, Robert Morgan

"A formal examination of a future road or traffic project, an existing road or any project which interacts with road users, in which an independent, qualified team looks at the project's accident potential and safety performance." (286)

UK and Australia have "road safety engineers" The UK's Institution of Highways and Transportation defines the practice as follows:

"Expertise in safety engineering is recognized as a combination of competence in techniques of accident investigation and remedial design, and underpinning knowledge of safety principles and relevant practice. In this context, safety specialists need to familiarize themselves with the wealth of information available, and keep abreast of new developments which will aid safe design."

The author states that road safety expertise is "largely the result of hands-on experience" (287). "Accident investigation and prevention courses and road safety audit training are essential steps for anyone developing road safety engineering skills. But they are only a base upon which experience needs to be placed." (287) The author stresses that a road safety audit is not a check of compliance with standards, but rather the application of professional judgment.

Chapter 14: Roadside Safety, Julie Anna Cirillo and Kenneth S. Opila.

"Several major stumbling blocks to improved roadside safety remain, including...the delay in transferring new knowledge, devices, and procedures to the field [and] the technology gap with maintenance personnel." (144)

Recommendation: "Require specific training for all maintenance personnel responsible for roadside devices. Inform them of the responsibility they have for saving lives." (144)

Chapter 27: Low-Cost Safety Improvement, Stanley F. Polanis

"Accumulating data on simple low-cost safety solutions may be difficult because the improvements are so commonplace that their evaluation is neglected." (271)

NCHRP Web Document 62 (Project 17-18[4]): Contractor's Final Report. Development of a Highway Safety Manual. March 2004.

The body of this report is devoted to the process for developing the outline of and work plan for a Highway Safety Manual. The introductory sections give a good indication of the progress of the science of highway safety analysis in recent years.

"There has been a growing recognition that transportation professionals do not have the needed tools to explicitly consider safety when making decisions related to the planning, design, construction, operations, and maintenance of transportation facilities, notably highways" (3).

"Better understanding of the statistical nature of crashes, coupled with new analytical tools, makes it possible to produce more valid estimates of the effect of geometric and operational changes on the frequency and severity of crashes" (4).

"Recent legislative requirements for improving safety data and the use of safety as an explicit criterion in planning and designing transport facilities have created needs within many agencies for improved tools and techniques for safety analysis" (4).

Persaud, Bhagwant N. NCHRP Synthesis 295: Statistical Methods in Highway Safety Analysis. Washington, D.C: National Academy Press, 2001.

To better understand how highway safety analysis is conducted in the field, the authors surveyed state departments of transportation in the US and provincial jurisdictions in Canada; 27 states and 5 provinces responded. The survey provided information on the kinds of analytical techniques and evaluations that are performed and the analysts who are performing them. While the focus of this report is on the analytical techniques themselves, there is some information relevant to the Safety PCB Program.

- 21 "Ranking of Critical Issues in Safety Analysis"
 In a survey of US state departments of transportation and Canadian provinces, the most critical issue for enhancing highway safety analysis was "appropriate skills, resources to conduct highway safety analysis."
- 22 "[Ongoing research]...emphasizes the need for analysts to continually refresh their knowledge."
- 23 "Formal training and refresher courses in statistical methods should be made available to all those charged with undertaking highway safety analyses."